Program Element: 33603F
DOD Mission Area: 333 - Strategic Communications

Title: Milstar Satellite Communications System (Space and Mission Control)
Budget Activity: 3 - Strategic Programs

1. RDT&E RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1986 Actual	FY 1987 Estimate	FY 1988 Estimate	FY 1989 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT		331,312	470,316			Continuing	N/A
2932	Milstar	331,312	470,316			Continuing	N/A

2. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The Milstar Satellite Communications System program is a joint service program to develop and acquire the Milstar Extremely High Frequency (EHF) satellite, its mission control segment, and new or modified communications terminals. The Milstar system will provide a highly survivable, jam-resistant, world-wide, secure communications system to meet the minimum essential wartime communications needs of the President and Commanders-in-Chief to command and control selected Air Force strategic and tactical forces through all levels of conflict. It will also support other high priority users in crisis/contingency situations. This Program Element funds for development of the Milstar satellite and its associated Mission Control Elements (MCE).

3. (U) COMPARISON WITH FY 1987 DESCRIPTIVE SUMMARY: ($ in thousands)

RDT&E	336,886	493,357	439,438	N/A	Continuing	N/A

EXPLANATION: FY 1986 and FY 1987 - Reductions due to Congressional action. FY 1988 - Net reduction of resulted from a two year funding slip of Developmental Flight Satellites #4 and #5 (DFS-4) (DFS-5) and a proportional share of the consultant costs reduction.

4. (U) OTHER APPROPRIATION FUNDS: Not Applicable.

5. (U) RELATED ACTIVITIES: The Air Force has total system development responsibility, heads the Joint Milstar Program Office and manages the development and acquisition of the space and mission control segments. Each Service manages a terminal program (Air Force for airborne and selected ground, Navy for shipborne and selected ground, and Army for ground) under the orchestration of the Milstar Joint Terminal Program Office managed by the Navy (PE 33603N).

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The Milstar program was initiated in FY 1982 with funds in the Space Communications program (PE 63431F) and Air Force Satellite Communications System (AFSATCOM) (PE 33601F). The Milstar Satellite Communications System (PE 33603F) was created in the FY 1983 President's Budget submission and contained both satellite and terminal development funds. However, beginning in FY 1984, Air Force Extremely High Frequency (EHF) terminal development is funded in Milstar Satellite Communications System (Air Force Terminals) (PE 33601F), formerly AFSATCOM, and the Milstar satellite and Mission Control Element (MCE) development is funded in Milstar Satellite Communications System (Space and Mission Control) (PE 33603F). This is consistent with all other DOD Satellite Communications (SATCOM) development and production programs. In addition to developing the new Milstar satellite, the Air Force is also managing the development and acquisition of the EHF applique packages for Fleet Satellite Communications vehicles F-7 and F-8 which are funded in the Navy's EHF SATCOM (PE 64577N). The Army and Navy terminals are funded under Satellite Communications Ground Environment (PE 33142A) and EHF SATCOM (PE 64577N and 33109N) respectively. Air Force Ground Mobile Forces terminals are being funded under Satellite Communications Terminals (PE 33605F). Development of Titan IVs to provide assured access to space for Milstar is funded in Space Boosters (PE 35119F).

6. (U) WORK PERFORMED BY: The development of the Milstar satellite and the MCE for the Milstar system is managed by Air Force Systems Command's Space Division, Los Angeles AFS, CA. The contract for Full Scale Development of the Milstar satellite and MCE was awarded on 30 June 1983. The prime contractor is Lockheed Missiles & Space Co., Sunnyvale, CA. Subcontractors to Lockheed include: Hughes Aircraft Co., El Segundo, CA (crosslink and frequency and time standards subsystems); TRW, Inc., Redondo Beach, CA (payload subsystem); General Electric Co., Valley Forge, PA (data handling subsystem); and Ford Aerospace Communications Corporation, Palo Alto, CA (crosslink receivers). The Aerospace Corporation, El Segundo, CA, provides general system engineering and integration.

7. (U) PROJECTS LESS THAN $10 MILLION IN FY 1988 AND/OR FY 1989: Not Applicable.

8. (U) SINGLE PROJECT OVER $10 MILLION IN FY 1988 AND/OR FY 1989:

(U) Project: #2932, Milstar Satellite Communications System (Space and Mission Control)

A. Project Description: This program designs, fabricates, tests, and acquires the Milstar EHF satellite consisting of the mainframe (or "bus"), the communications payload, antenna suite and the MCE. The system will incorporate state-of-the-art techniques for jam-resistance and survivability. Key features include higher frequencies, bandspreading, on-board signal processing, end-to-end encryption, hardening, [redacted] a high degree of autonomy and on-orbit storage. A special endurance feature of Milstar is the MCE which will allow selected command terminals located on survivable platforms to control the satellite/system. An Ultra High Frequency (UHF) package will provide backward compatibility with existing UHF systems and facilitate the transition to EHF. This program will provide world-wide, two-way, jam-resistant, secure, highly survivable and enduring communications capability.

B. (U) Program Accomplishments and Future Efforts:

(1) (U) FY 1986 Accomplishments: The primary effort included continued, detailed design work and completion of the satellite and mission control segments Preliminary Design Reviews. Major emphasis was placed on detailed planning for payload testing and integration of the payload into the satellite bus. Some satellite subsystem Critical Design Reviews (CDR) were conducted. Fabrication of Developmental Flight Satellite #1 (DFS-1) continued, and options for the fabrication of DFS-2 and long lead for DFS-3 were exercised. The National Aeronautics and Space Administration termination of the Centaur Upper Stage program for Space Transportation System (STS) safety reasons resulted in the deletion of the requirement for satellite dual compatability between the Titan IV and the STS. As a result, the Milstar satellite will now be launched solely using Titan IVs and Centaur Upper Stages.

(2) (U) FY 1987 Program: The primary effort will be fabrication and testing of the DFS-1 and its communications payload. Long lead for DFS-3 will continue, and the fabrication option will be exercised. Long lead for DFS-4 will be exercised. Fabrication of DFS-1 and DFS-2 will continue. The system level CDR for the space segment and subsystem level CDRs for the mission control segment are planned. Major emphasis will be placed on integration of the satellite with the Centaur Upper Stage and then integration of the spacecraft and Centaur with the Titan IV. Development of system level end-to-end test plans will be completed and initial system level testing will begin. Preliminary planning for Initial Operational Test and Evaluation of the Mission Control Element (MCE) will start on both ground and airborne platforms.

(3) (U) FY 1988 Planned Program and Basis for FY 1988 RDT&E Request: The basic program includes completion of the final bus assembly for DFS-1, integration of the payload onto the spacecraft, continued fabrication of DFS-2 and DFS-3. The system level CDR will be conducted for the MCE. Platform design work will be conducted for future installation of engineering development model MCEs. Launch system integration of the Milstar spacecraft with the Titan IV will continue. Cost estimates are mature, Category II and based on current contract awards, an update to the Independent Cost Analysis for the satellite and MCE completed in November 1984, and a Single Best Estimate for the satellite and MCE completed in November 1986.

(4) (U) FY 1989 Planned Program and Basis for FY 1989 RDT&E Request: DFS-1 hardware and software integration will continue. Bus and payload integration will be completed. Qualification testing and system level acceptance testing will continue. Fabrication of DFS-2 and DFS-3 will continue. Cost estimates are mature, Category II and based on current contract awards, an update to the Independent Cost Analysis for the satellite and MCE completed in November 1984, and a Single Best Estimate for the satellite and MCE completed in November 1986.

(5) Program to Completion: This is a continuing program. Development work will continue on the satellite and MCE with launch of DFS-1 scheduled for not later than [ ] (Developmental satellites two through five will be launched by [ ]) All satellites will be launched solely using Titan IVs and Centaur Upper Stages. Satellite production, commencing with satellite number six, is scheduled to begin in FY 1992. Installation of engineering development model MCEs will begin in FY 1990. Installation of production MCEs will begin in FY 1994.

C. Major Milestones:

		Milestones		Dates
(1)	(U)	Program Start		April 1981
(2)	(U)	Start Concept Validation Phase		March 1982
(3)	(U)	Full Scale Development Contract		June 1983
(4)	(U)	Satellite Payload Preliminary Design Review (PDR)		July 1984
(5)	(U)	Satellite System PDR		November 1985
(6)	(U)	Start Fabrication of Developmental Flight Satellite #1 (DFS-1)	*(December 1985)	September 1986
(7)	(U)	Satellite System Critical Design Review (CDR)		FY 1987
(8)	( )	Delivery of satellite to launch facility	[	]
(9)	( )	Launch of DFS-1	[	]
(10)	( )	Launch of tenth Milstar satellite (Approximate Full Operational Capability)	[	]

* Date presented in FY 1987 Descriptive Summary

(U) Explanation of Milestone Changes

(6 & 7) (U) Date of the start of fabrication of DFS-1 changed to reflect the program slip due to the Balanced Budget and Emergency Deficit Control Act of 1985 (Gramm-Rudman-Hollings).

(9) (U) Date of first launch was changed to reflect the program rephase, Gramm-Rudman-Hollings impact, and the 22 August 1986 Department of Defense decision to delay launch of first satellite up to one year.

9. (U) COOPERATIVE AGREEMENTS: Not Applicable.

Budget Activity: 3, Strategic Programs
Program Element: 33603F, Milstar Satellite Communications System (Space and Mission Control)

Test and Evaluation Data

1. (U) Development Test and Evaluation (DT&E): The Full Scale Development contract for the Space and Mission Control Segments was awarded in FY 83 and DT&E has started.

(U) Test Schedule

( ) Satellite and Mission Control Element (MCE) Part/Circuit/Box Level Survivability Tests

( ) Interface Tests - Payload to Terminal
- MCE to Satellite
- MCE to Air Force Terminal

( ) System Level End-to-End Tests (Performance, Survivability, Interoperability)

( ) On-Orbit DT&E Tests

(U) In March-April 1986 the Navy contractors tested their Engineering Development Model (EDM) terminals with the Fleet Satellite Extremely High Frequency (EHF) package (FEP) flight model F-7. In October 1986, the Navy contractors tested their EDM terminals with the FEP flight model F-8. All ambiguities, incompatibilities, and areas of concern from the July-August 1985 tests with the FEP prototype were successfully retested to ensure resolution. No new ambiguities or incompatibilities were detected.

(U) Milstar is a joint service program with participation by all services. The Air Force has been designated Executive Agent for Milstar. The Joint Milstar Program Office provides overall management of the Milstar program and is located at Air Force Systems Command's Space Division in Los Angeles, CA. The Space and Mission Control Segments of the Milstar program are managed from Space Division. The Terminal Segment efforts are orchestrated by the Joint Terminal Program Office (JTPO) which is a part of the Navy's Space and Naval Warfare Systems Command in Washington, DC (Program Element [PE] 33603N). The JTPO provides guidance and system engineering support to each service terminal program office. The Air Force terminal program office is located at Air Force Systems Command's Electronic Systems Division, Hanscom AFB, MA. The Air Force terminal program is discussed in the Test and Evaluation Data Sheet for PE 33601F, Milstar Satellite Communications System (Air Force Terminals). The Navy terminal program office is located at Space and Naval Warfare Systems Command's Navy EHF Satellite Communications Terminal Program Office, Washington, DC. The Navy Milstar terminal effort is contained in PE 64577N and PE 33109N. The Army terminal program office is located in Communications-Electronics Command's Single Channel Objective Tactical Terminal Project Office, Fort Monmouth, NJ. The Army Milstar terminal effort is contained in Program Element 33142A. Space Division is responsible for DT&E of the Space and Mission Control Segments of the Milstar System. The responsible agency for the Space and

and Mission Control Segments Initial Operational Test and Evaluation (IOT&E) is the Air Force Operational Test and Evaluation Center (AFOTEC). Air Force Space Command is designated the system operator and will be responsible for operation of the Milstar satellite constellation as well as the Mission Control Segment. Air Force Logistics Command will be responsible for maintenance of the Mission Control Segment.

(U) Lockheed Missiles and Space Company, Sunnyvale, CA, is under contract to Space Division for the general systems engineering and the Space and Mission Control Segments. The Air Force airborne and ground communications terminals are being developed by Raytheon in Sudbury, MA. The Navy's seaborne terminals are being developed by Raytheon in Sudbury, MA. The Army terminals are being developed by Magnavox, Ashburn, VA.

2. (U) Operational Test and Evaluation (OT&E):

(U) Responsible Organizations: AFOTEC has been designated the lead agency for conducting a multiservice IOT&E program for the overall Milstar system. AFOTEC, the Army Operational Test and Evaluation Agency (OTEA), and the Navy Commander, Operational Test and Evaluation Force (COMOPTEVFOR), will participate in the multiservice IOT&E which will take place as a combined Development Test and Evaluation (DT&E)/OT&E effort. A multiservice test team will be formed with representatives from Air Force, Army, Navy, and the Defense Nuclear Agency (DNA) to conduct the IOT&E testing.

(U) Test Approach. A system/mission oriented test approach has been developed which will test the Milstar system from the perspective of its capability to satisfy end-to-end mission communications requirements. Testing will be conducted in two phases. The first phase will involve participation in final in-plant DT&E, particularly the system end-to-end test, and field test with Developmental Flight Satellite #1 (DFS-1) on-orbit. Testing in Phase I will be conducted as both a combined DT&E/IOT&E and a dedicated IOT&E. Phase II will involve field tests with DFS-2 on-orbit and will be conducted as a dedicated IOT&E. In both Phase I and Phase II testing, the approach will be to establish and test communications networks which are as representative as possible of networks required in the Joint Milstar Communications and Control Operations Concept. The network testing will evaluate terminal interoperability (terminals of all three services) and system connectivity in realistic network communications scenarios. Two reports will be provided, an interim report at the completion of Phase I test and a final report at the completion of Phase II test. Each service will prepare and staff independent evaluation reports. In addition, the services will prepare and staff a joint report which consolidates the findings of all three services.

(U) Test Planning: AFOTEC, in conjunction with OTEA and COMOPTEVFOR, is accomplishing early IOT&E planning.

(U) The critical issues were prepared and coordinated with the Army, Navy, and Marine Corps.

(U) The Test Program Outline (TPO) was prepared and includes resources from Air Force, Army, and Navy.

(U) The Multiservice test approach was prepared by AFOTEC and coordinated with Army, Navy, and Marine Corps.

(U) The Multiservice Test and Evaluation Master Plan will be submitted on 31 Dec 86 for OSD review/approval.

Budget Activity: 3, Strategic Programs
Program Element: 33603F, Milstar Satellite Communications System (Space and Mission Control)

Planned IOT&E: Testing will commence in early [ ] with Phase I and continue through Phase II test with Developmental Flight Satellite #2 (DFS-2) on-orbit. Key events are:

(1) (U) Publish Milstar Multiservice IOT&E Test Plan - Oct 88

(2) ( ) Form Multiservice Test Team - [ ]

(3) ( ) First Test Event - [ ]

(4) ( ) Phase I Test Report - [ ]

(5) ( ) Final Test Event/Final Test Report - [ ]

(6) ( ) Report Briefings - [ ]

(7) ( ) Dissolve Test Team - [ ]

3. (U) System Characteristics:

Characteristic	Objective/Threshold	Demonstrated
(U) Survivability		
( ) Jam Resistant	[ ]	Future Tests
( ) Low Probability of Intercept	[ ]	Future Tests
) Nuclear Scintillation	[ ]	Future Tests
(U) Performance		
( ) Capacity	Nominally [ ]	Future Tests
( ) Constellation Time Control	[ ]	
( ) Constellation Ephemeris Control	[ ]	Future Tests
(U) Mission Control Element (MCE) Mean Time Before Failure	600 hours	Future Demonstration